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(19) (CA) **APPLICATION FOR CANADIAN PATENT** (12)

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(54) Adjustable Reflection Control Device for Fiber Optics

(72) Liao, Hung-Huei - Taiwan ;
Liaw, Jy-Wang - Taiwan ;
Lin, Do-Chung - Taiwan ;
Tu, Yuan-Kuang - Taiwan ;

(71) Telecommunication Laboratories, Directorate General of Telecommunications, Ministry of Transportation and Communications - Taiwan ;

(57) 1 Claim

Notice: This application is as filed and may therefore contain an incomplete specification.

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ABSTRACT

AN ADJUSTABLE REFLECTION CONTROL DEVICE FOR FIBER OPTICS

An adjustable reflection control device for fiber optics comprising a resolution adjustment knob, a small shaft, a small gear, a large gear, a large shaft and a fiber optic coupler wherein the resolution of the device is proportional to the diameter of the shaft, the larger the radius of the shaft is, the smaller the rate of change of the bending loss will be, hence, the resolution obtained can be higher. The reflection of the fiber optics can be indicated on the adjustment knob. Whenever the diameter of the shaft has to be changed, only the shaft needs to be changed and the gear remains unchanged.

AN ADJUSTABLE REFLECTION CONTROL DEVICE FOR FIBER OPTICS

(a) Field of the Invention

The present invention relates to an adjustable reflection control device for fiber optics. More specifically, the present invention relates to an adjustable reflection control device which can be used in system testing and instrumentation measurement as well as sensor testing of fiber optic devices.

(b) Description of the Prior Art

A conventional fiber optic reflection control device mainly adjusts the angle between the fiber optic source and the reflection mirror to vary the reflection. The manufacturing of this device requires highly precision advanced technology and the device also requires proper maintenance. Therefore, its cost is relatively high. The present invention provides a low-cost adjustable fiber optic reflection control device which does not require advanced technology to fabricate. Its basic principle is the use of the fiber optic bending loss characteristic so as to adjust the degree of reflection.

The main object according to the present invention is to provide a design of the adjustable reflection control device for fiber optics which does not require

advanced technology to manufacture and a protective device is not needed either. This new design uses the fiber optic bending loss characteristic to overcome the above and other difficulties. It is simple of construction and economical of manufacture. It is a practical device which is suitable for mass production.

The drawings disclose an illustrative embodiment of the present invention which serves to exemplify the various advantages and objects hereof, and are as follows:

FIG. 1A is a diagrammatic view of a fiber optic coupler of the adjustable reflection control device according to the present invention. This view shows the fiber optics without bending;

FIG. 1B is a diagrammatic view of a fiber optic coupler of the adjustable reflection control device according to the present invention. This view shows the fiber optics are loop around a circle to form a bending loss;

FIG. 2A is a scheme showing the resolution adjustment knob for the reflection control device according to the present invention;

FIG. 2B shows the major components of an assembly

of the reflection control device for fiber optics according to the present invention;

FIG. 2C shows the direction of rotation of the large and the small gears according to the present invention; and

FIG. 2D is a scheme showing the adjustable reflection control device for fiber optics according to the present invention.

The bending loss characteristic of fiber optics used in the reflection control device is first discussed. Referring to FIG. 1A, which shows a fiber optic coupler 1 for the adjustable reflection control device according to the present invention. This is a 3 dB 1x2 fiber optic coupler in which:

a is the input, b is the output and c is the reflection.

Assume that the input power at a is P = 1 dBm, and

Rate of reflection at c is -2 dB

(1) For the case without any bending loss, as shown in FIG. 1A, the reflection at the output end b can be represented by P where:

P = 1 dBm - 2 dB - (3 dB x 2) = -7 dBm

Total reflectivity = - 7 dBm - 1 dBm = -8 dB

where (3 dB x 2) as shown in the above equation is the double pass loss of the fiber optic coupler 1.

(2) For the case in which the fiber optics coil around a circle 2 to generate a bending loss of -10 dB, as is shown in FIG. 1B. The reflected power P at the output end b can be represented by:

P = 1 dBm - 2 dB - (3 dB x 2) - (10 dB x 2) = -27 dBm

Total reflectivity = -27 dBm - 1 dBm = -28 dB

Similarly, (3 dB x 2) as shown in the above equation is the double pass loss of the fiber optic coupler 1.

The bending loss varies with the diameter (2r) of the loop circle. The smaller the diameter is, the higher the bending loss will be. Therefore, the reflection at the output end b will be smaller. In general, a complete reflection can be obtained when the reflection at c has a high reflectivity coating. When the fiber optic 3 is cut to have a flat surface, the reflectivity can be as high as -15dB. Hence, when the return loss of the fiber optic coupler is -65 dB and the insertion loss is less than 3 dB, we can obtain -65 dB

to -6 dB of reflection using this technology.

The design principle and installation of the fiber optic reflection control device will be discussed next.

Referring to FIG. 2A, which shows a diagrammatic drawing of the resolution adjustment knob for the reflection control device according to the present invention. It consists of a resolution adjustment knob 21 which has markings to indicate the degree of reflection. The bottom of the resolution adjustment knob 21 is connected to a small shaft 20. The bottom of the small shaft 20 is connected to an insertion member 26 which can be inserted into the central hole of the small gear 22. The bending loss of the fiber optics is proportional to the number of loops formed by the fiber optics. In addition, its resolution is proportional to the diameter of the shaft 20. The larger the diameter of the shaft is, the smaller the rate of change of the bending loss will be and the better the resolution will be. The reflection can be directly indicated on the marking of the adjustment knob. Whenever the diameter of the shaft 20 has to be changed to another shaft 20', the gear 22 does not require to be changed.

Referring to FIG. 2B, which shows a diagrammatic drawing of the major components of an assembly of the

fiber optic reflection control device according to the present invention. The small shaft 20 is used to adjust the level and degree of reflection, as described in the previous section. The large shaft is mainly used to collect and send the fiber optics. Therefore, the diameter of the large shaft shall be greater than the diameter of the unit without inducing the bending loss. Depending on the characteristics of the fiber optics, this diameter is generally 5 centimeter. Referring to FIG. 2C for the rotational direction of the large and the small gears according to the present invention. If the pitch of the large gear 24 and the small gear 22 are identical, and the teeth ratio of the large gear to the small gear is approximately equal to the ratio of their diameters, then the synchronous out-of-phase send and collection of the fiber optic length are identical. There is no twisting loss. Also, the smaller the pitch is, the more precise the result will be. In addition, the diameter of the large gear 23 is much larger than the diameter of the small gear 20, all it requires is 1 to 2 loops of circle. The fiber optic coupler 25 is secured on the case. Please refer to FIG. 2D for a diagrammatic drawing the reflection control device for fiber optics according to the present invention.

The adjustable reflection control device for fiber optics according to the present invention has the

following features:

(1) The components for the assembly are easy to obtain.

(2) The structure of the device is very flexible. The resolution only varies with the diameter of the small shaft. Therefore, the adjustment can be performed in any manner.

(3) The design is new. It fully utilize the characteristics of the fiber optics. Hence, advanced technology required in manufacturing and maintenance is eliminated and the cost is driven to be lowered.

(4) The structure is simple and is easy to fabricate. It is practical to meet the demands of low cost and is suitable for mass production.

While there have been shown and described what are considered at present to be the preferred embodiments of the present invention, it will be appreciated by those skilled in the art that modifications of such embodiments may be made. It is therefore desired that the invention not be limited to these embodiments, and it is intended to cover in the appended claims all such modifications as fall within the time spirit and scope

of the invention.

CLAIME :

1. An adjustable fiber optic reflection control device comprising:

a resolution adjustment knob which has markings to indicate the degree of reflection, the bottom of the resolution adjustment knob is connected to a small shaft;

the small shaft, having its bottom part connected to an insertion member which can be inserted into the central hole of said small gear;

a small gear;

a large gear in which the pitch is identical to that of small gear , the teeth ratio of the large gear to the small gear is approximately equal to the ratio of their diameters, thus, the synchronous out-of-phase transmission and receiving of the fiber optic length are identical, also, the smaller the distances between the teeth gear are, the more precise the result will be;

a large shaft, which is mainly used to transmit and

receive fiber optics, the diameter of the large shaft is greater than the diameter of the unit without inducing any bending loss;

a fiber optic coupler which is mounted on the case of the device;

wherein the adjustable fiber optic reflection control device utilizes the ratio of the bending loss to the number of loops that the fiber optic formed, the resolution of the device is proportional to the diameter of the shaft, the larger the radius of the shaft is, the smaller the rate of change of the bending loss will be, hence, the resolution obtained can be higher, the reflection of the fiber optic can be indicated on the adjustment knob, whenever the diameter of the shaft has to be changed, only the shaft needs to be changed and the gear remains unchanged.

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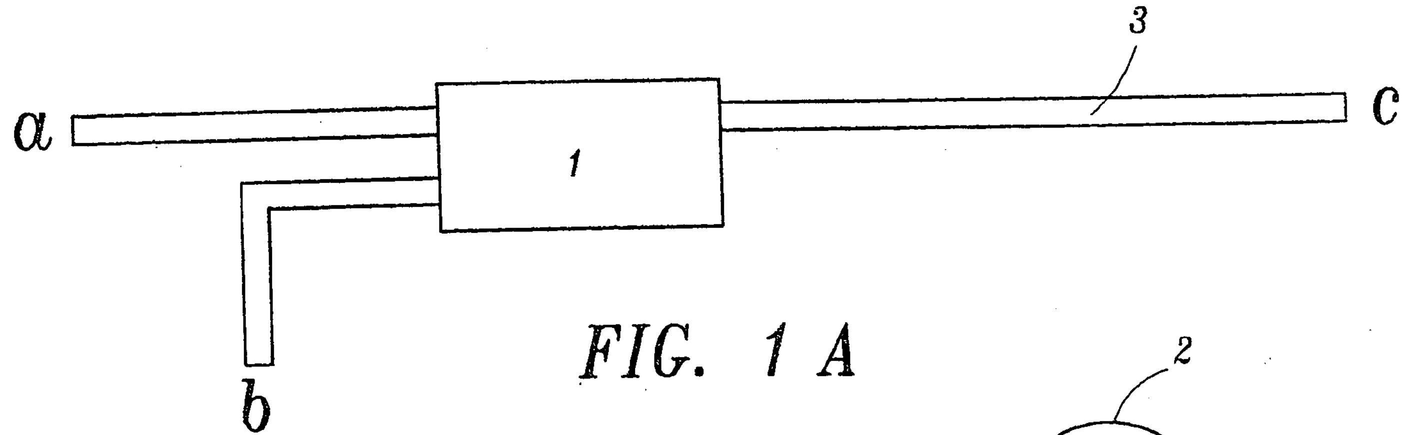

FIG. 1 A

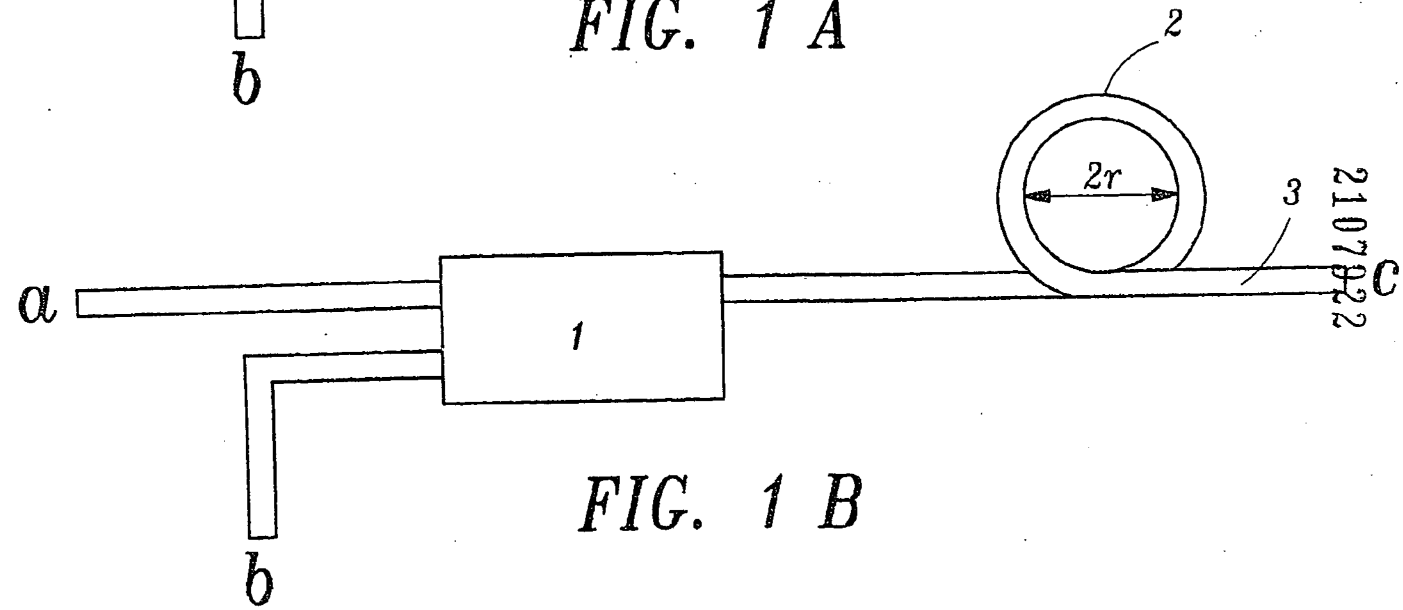

FIG. 1 B

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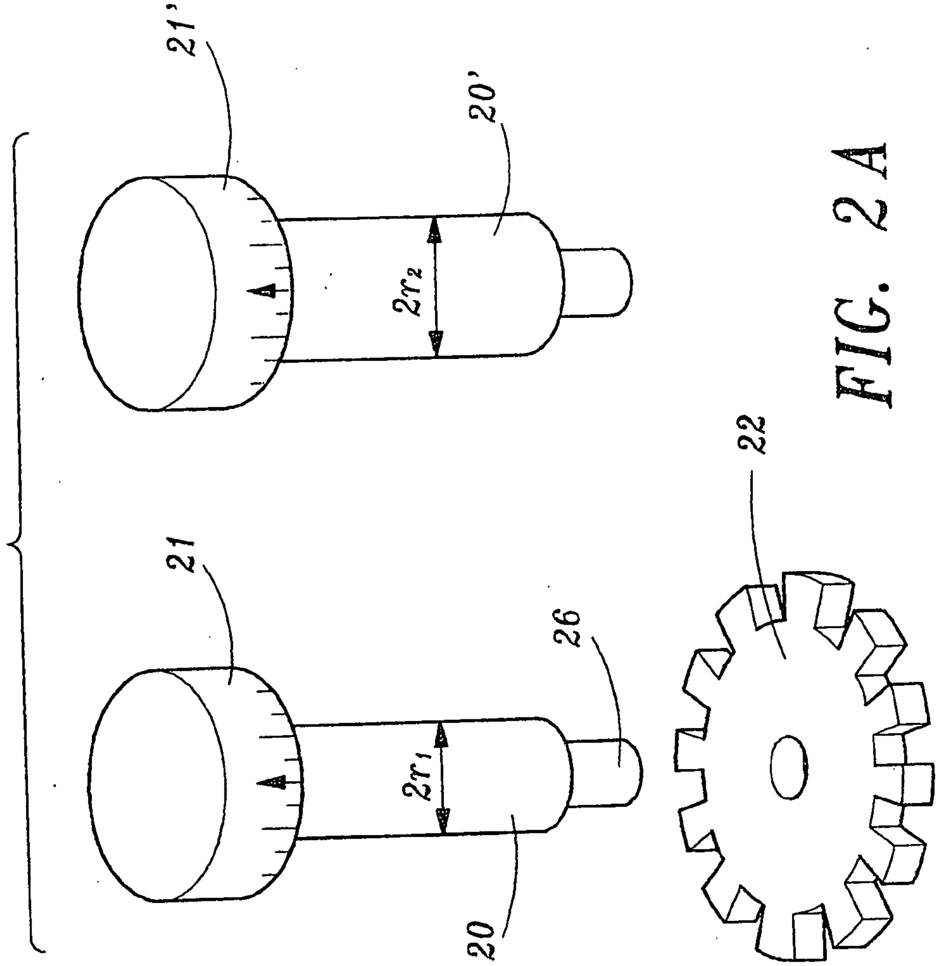

FIG. 2A

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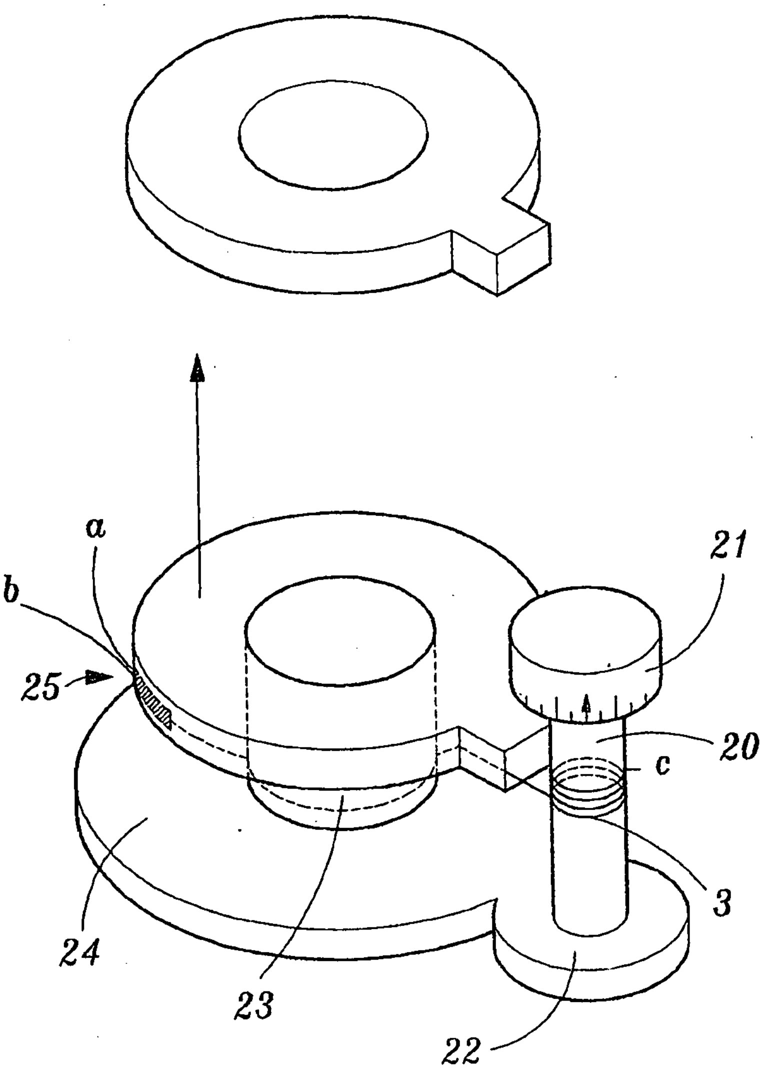

FIG. 2B

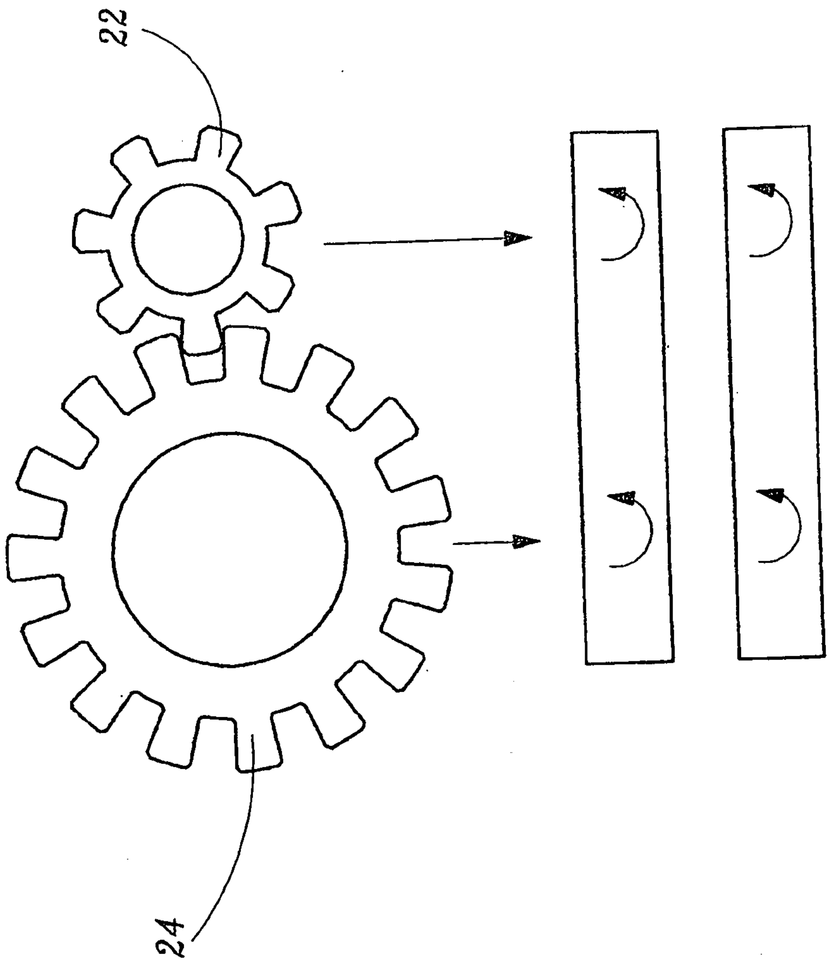

FIG. 2C

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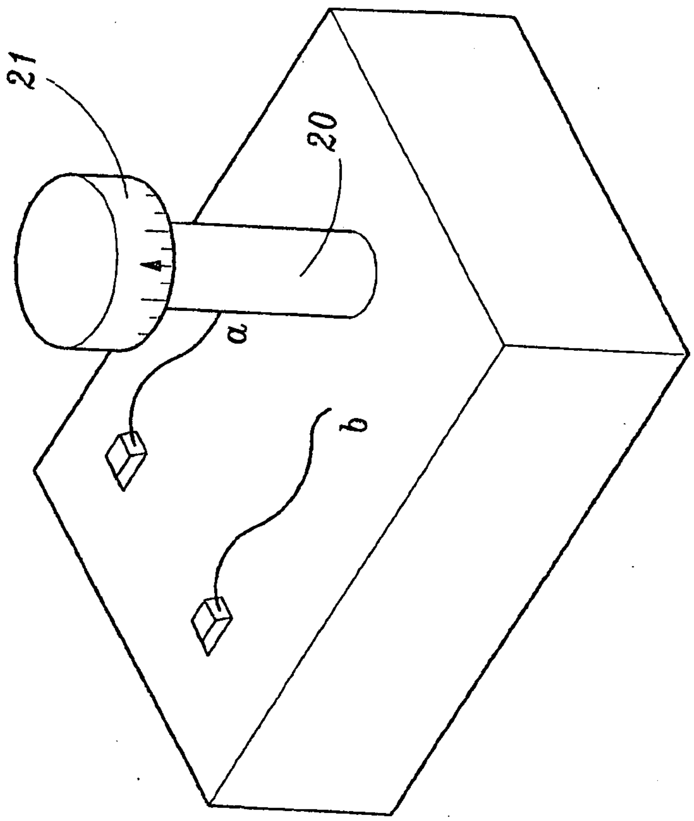

FIG. 2D

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